US007029297B1

(12) United States Patent
Co et al.

(10) Patent No.: US 7,029,297 B1
(45) Date of Patent: Apr. 18, 2006

(54) PC-MOTHERBOARD TEST SOCKET WITH LEVERED HANDLES ENGAGING AND PUSHING MEMORY MODULES INTO EXTENDER-CARD SOCKET AND ACTUATING EJECTORS FOR REMOVAL

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/905,276**

(22) Filed: **Dec. 23, 2004**

(51) **Int. Cl.**
H01R 11/20 (2006.01)

(52) **U.S. Cl.** **439/152**; 439/160

(58) **Field of Classification Search** 439/152, 439/160

See application file for complete search history.

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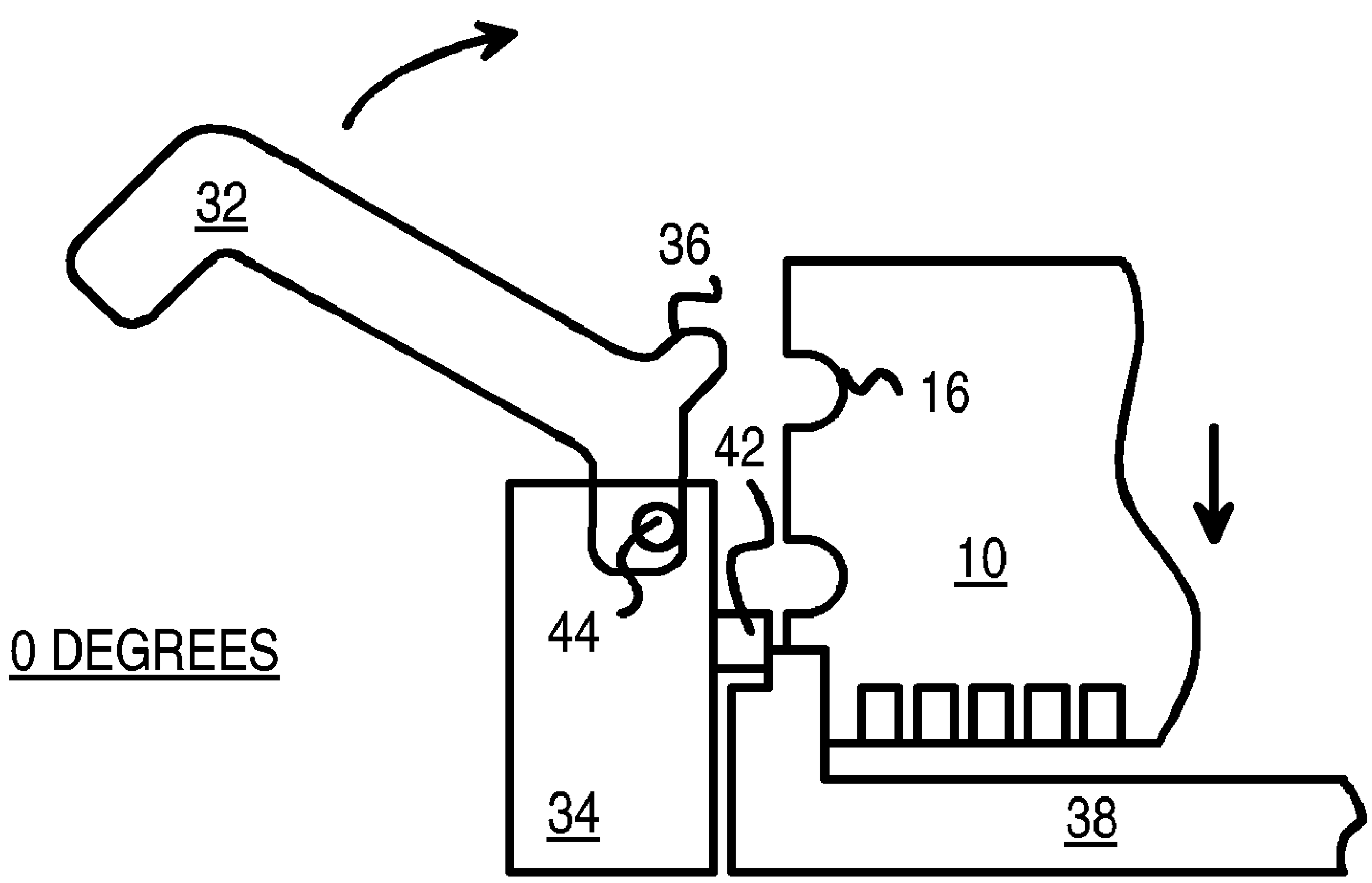
(57) **ABSTRACT**

A memory module socket requires a reduced insertion force because a notch engager on a levered handle engages a notch on the memory module and applies downward pressure. The notch engager is forced downward as the levered handle pivots about an axis, causing the downward force to be applied to the notch on a memory module, forcing the memory module into a memory module socket on an extender card that plugs into a memory module socket on a personal computer motherboard. An ejector arm is pushed downward by the levered handle during removal. An ejector foot inside the memory module socket is pivoted upward around an ejector pivot when the ejector arm is pushed downward. The upward pivoting ejector foot pushes upward on the inserted edge of the memory module, forcing the memory module out of the memory module socket. Both ejection and insertion forces can be reduced.

22 Claims, 9 Drawing Sheets



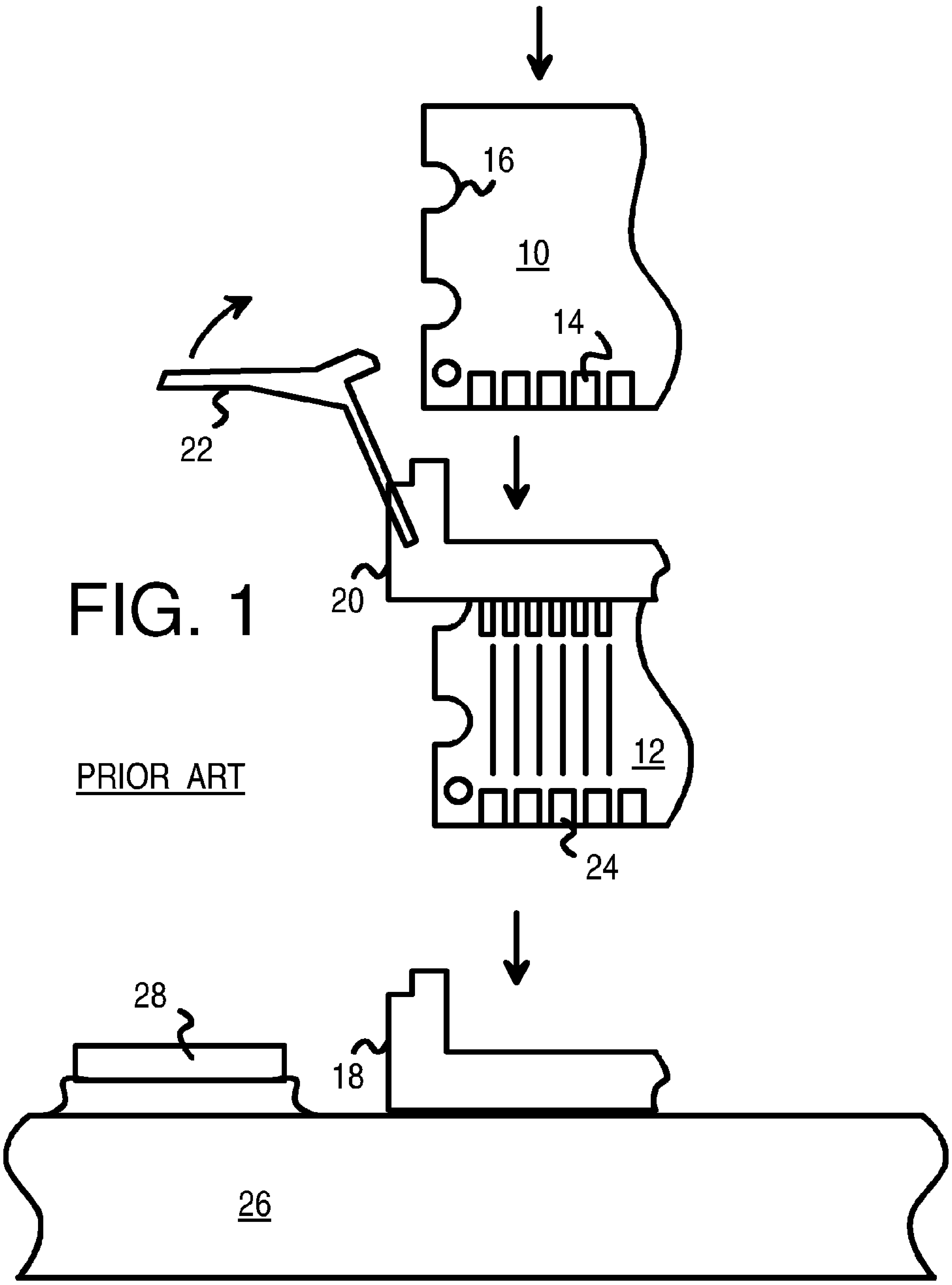


FIG. 1

PRIOR ART

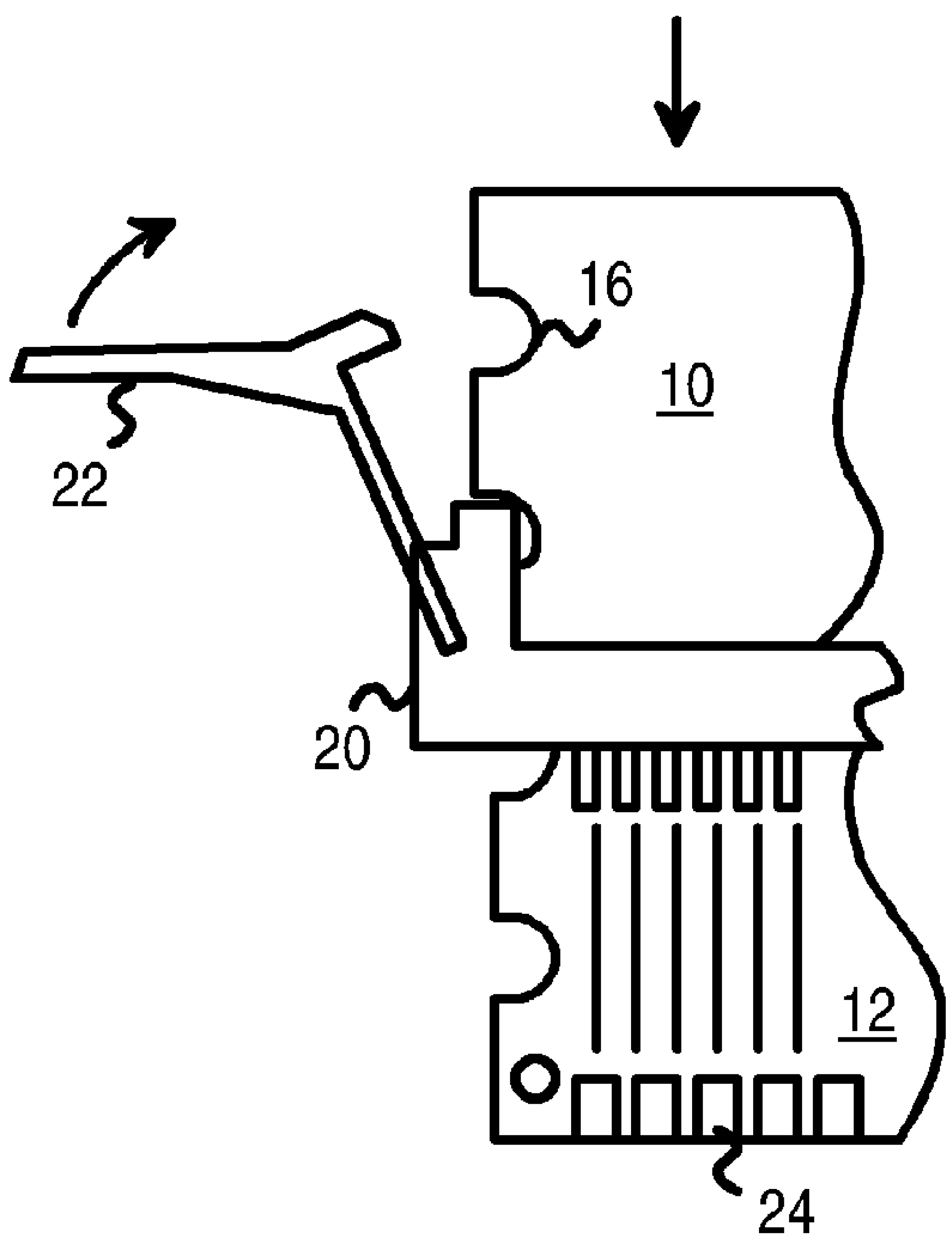


FIG. 2A

PRIOR ART

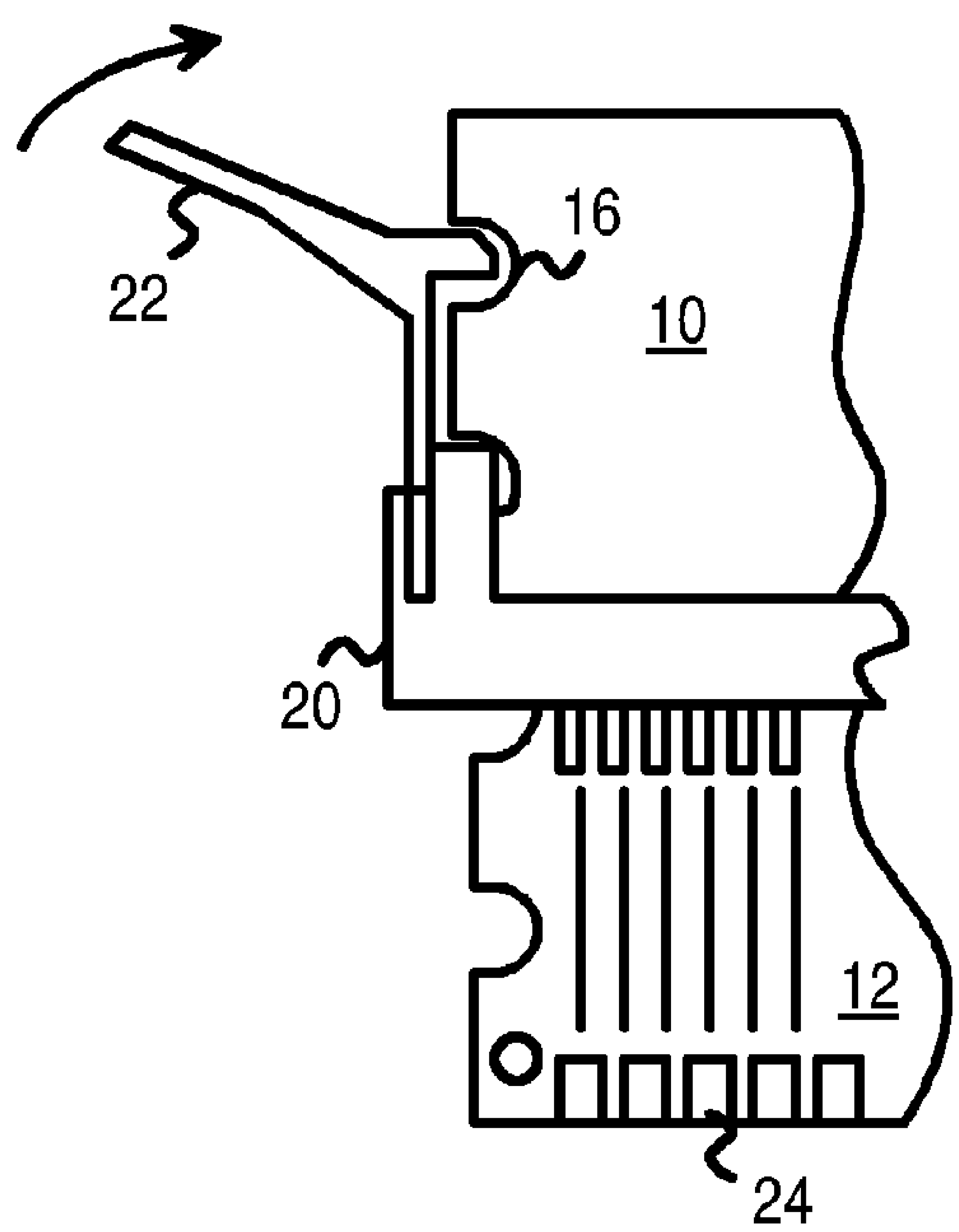


FIG. 2B

PRIOR ART

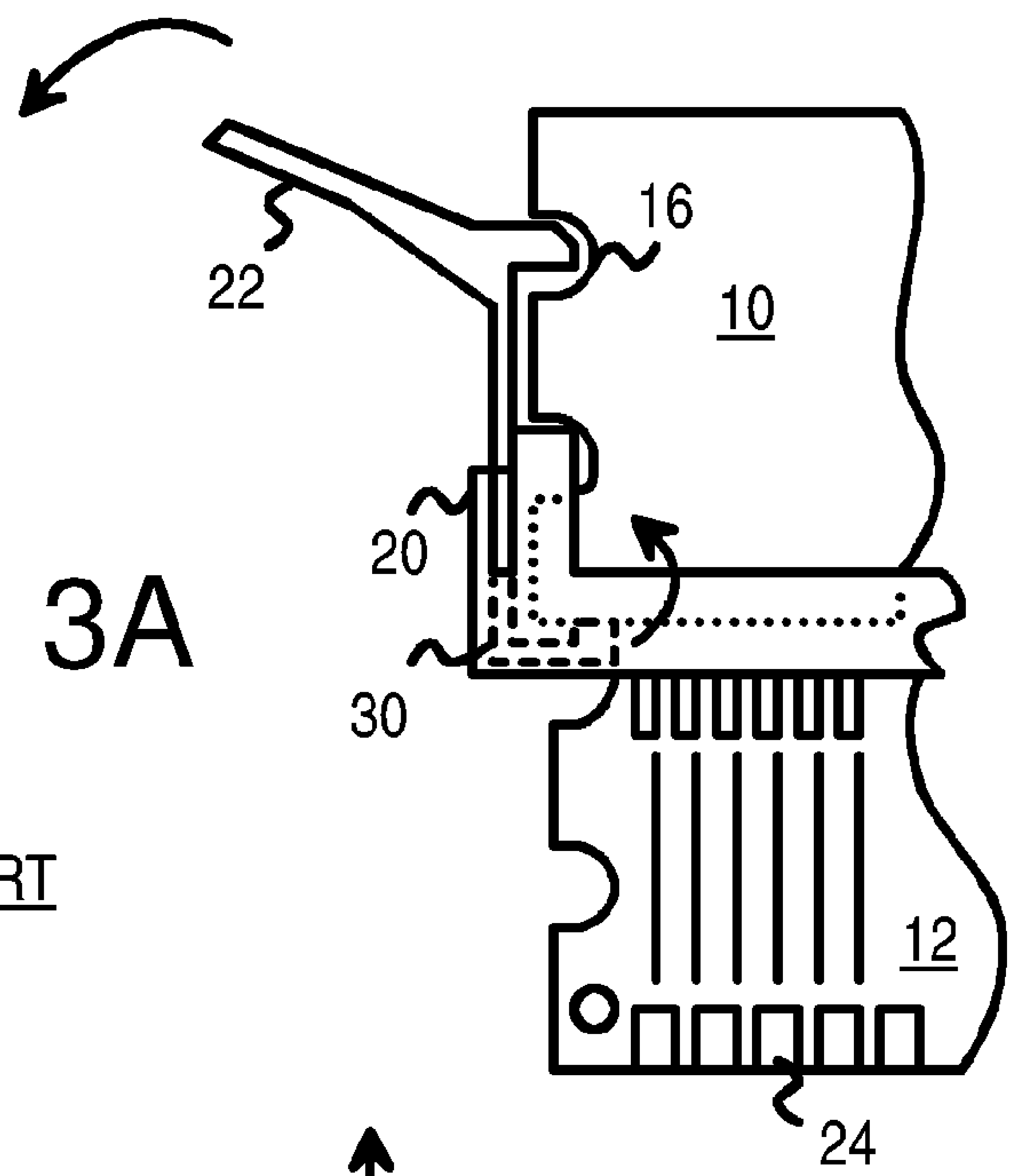


FIG. 3A

PRIOR ART

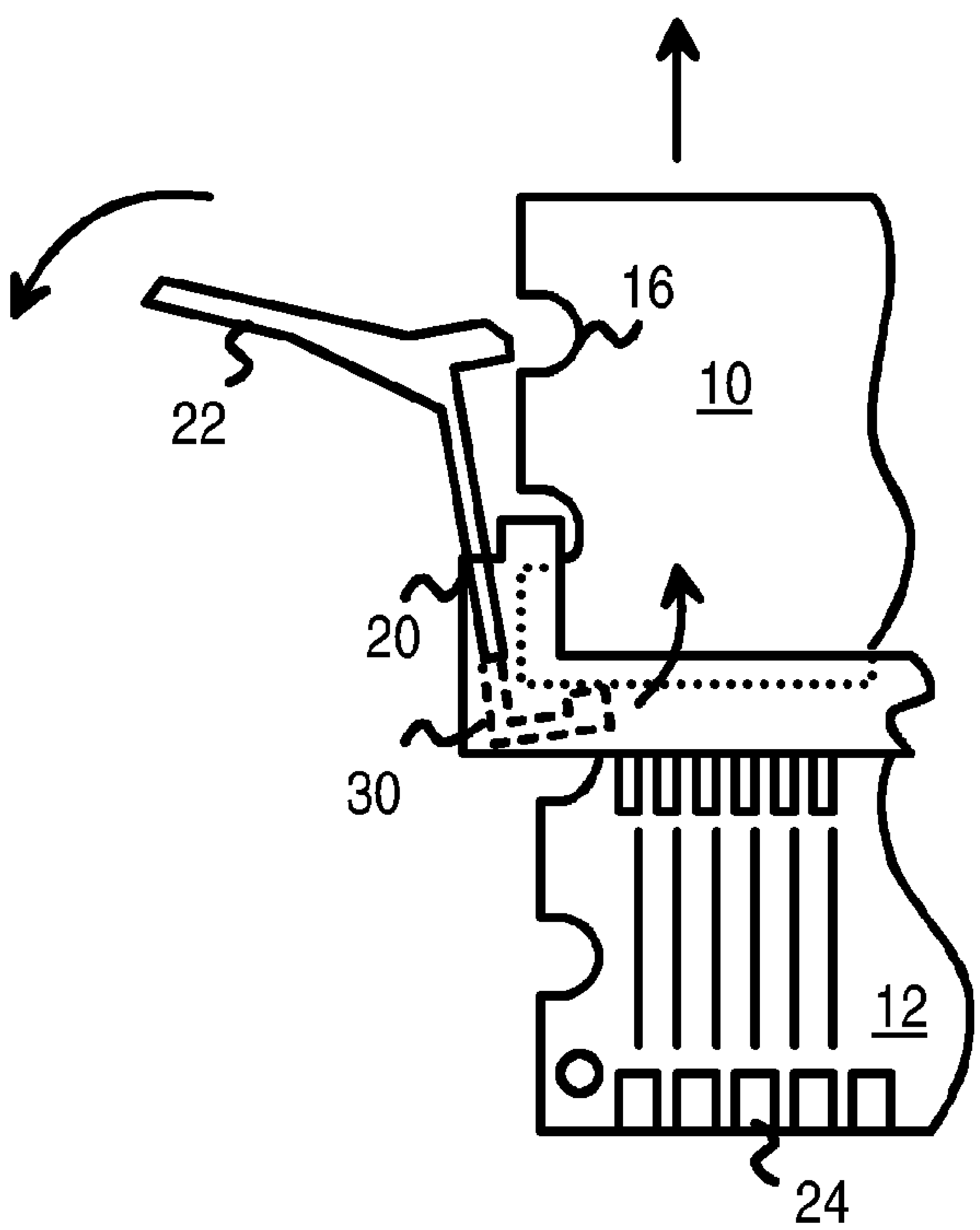


FIG. 3B

PRIOR ART

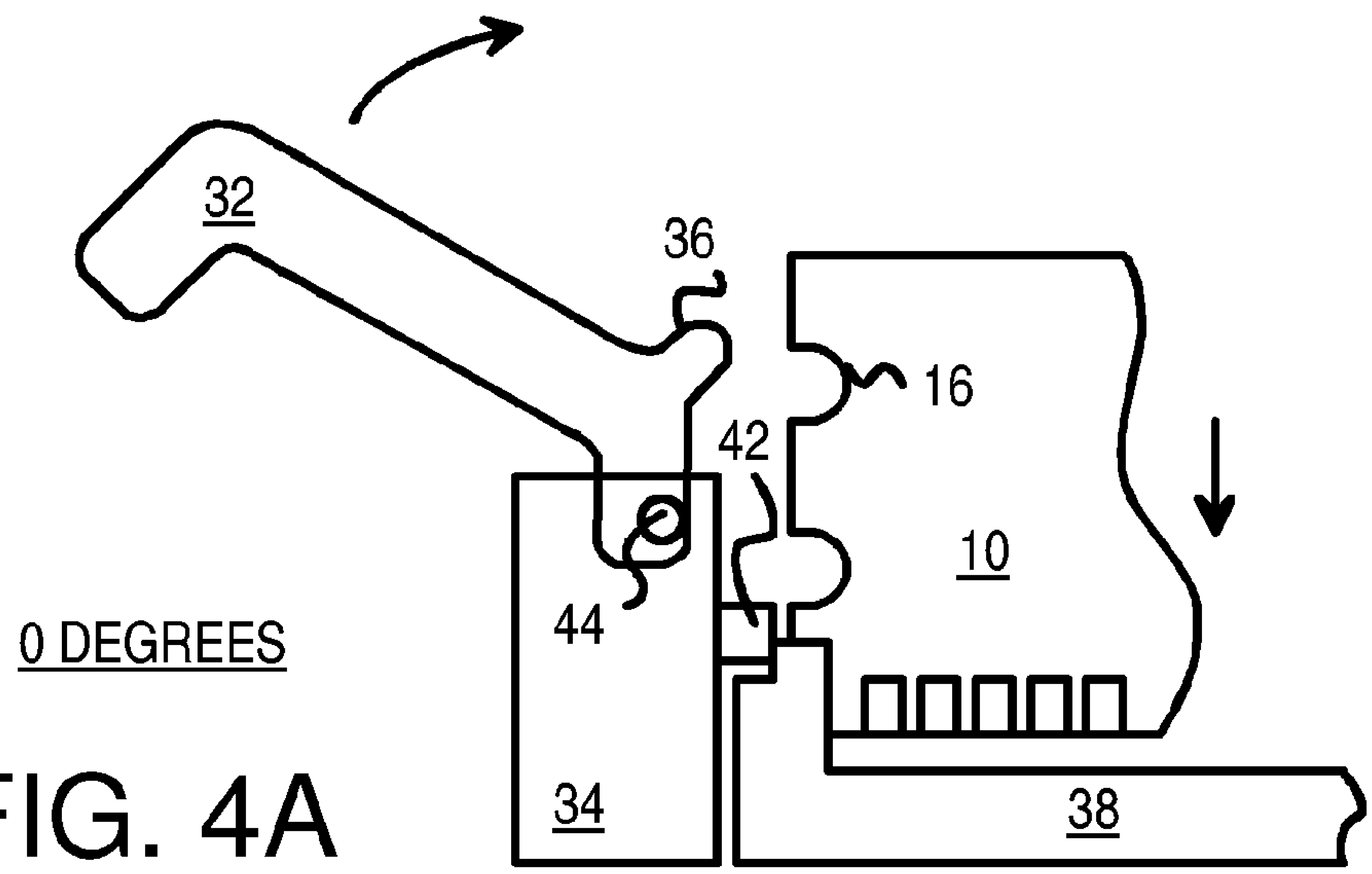


FIG. 4A

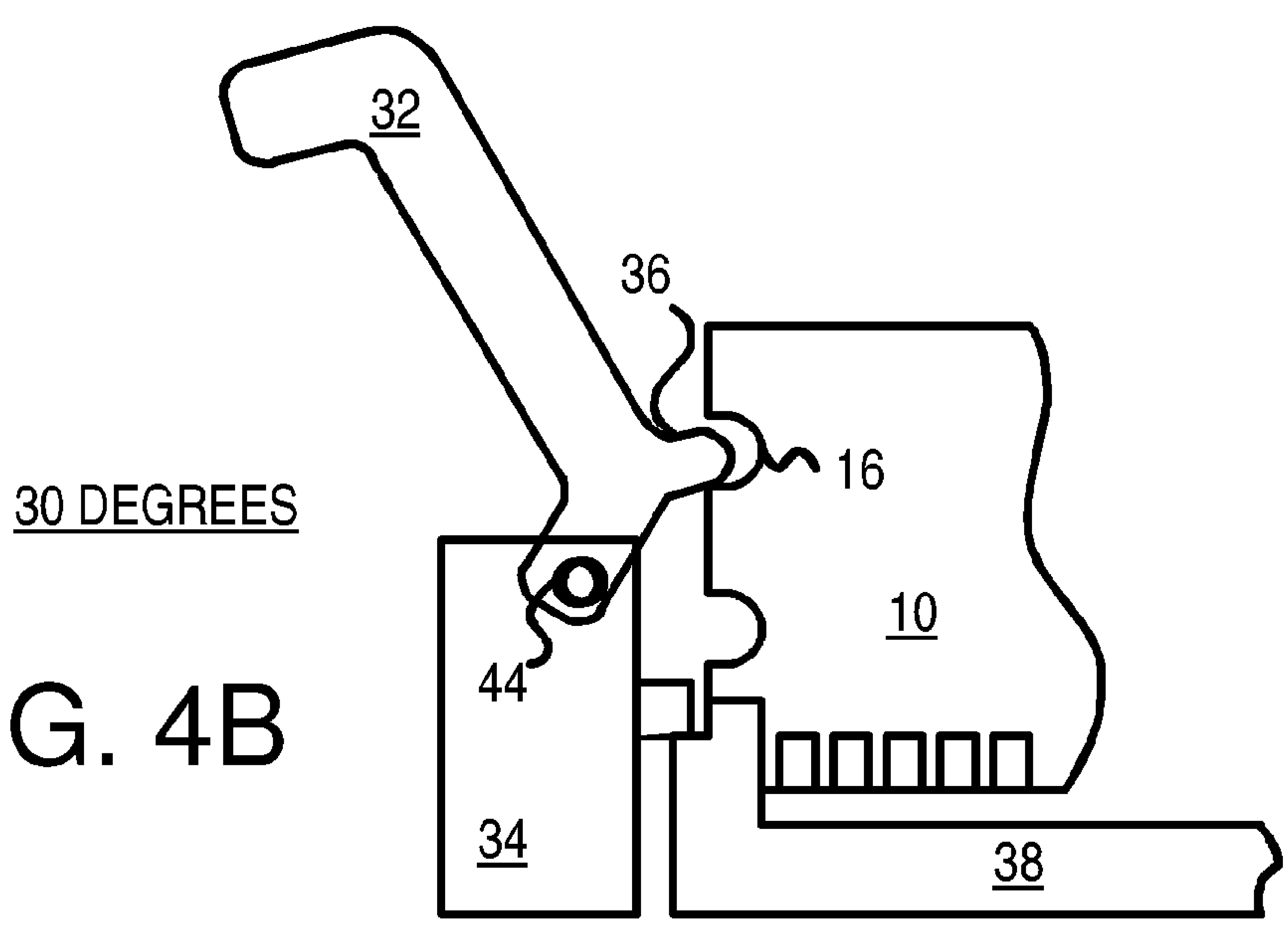


FIG. 4B

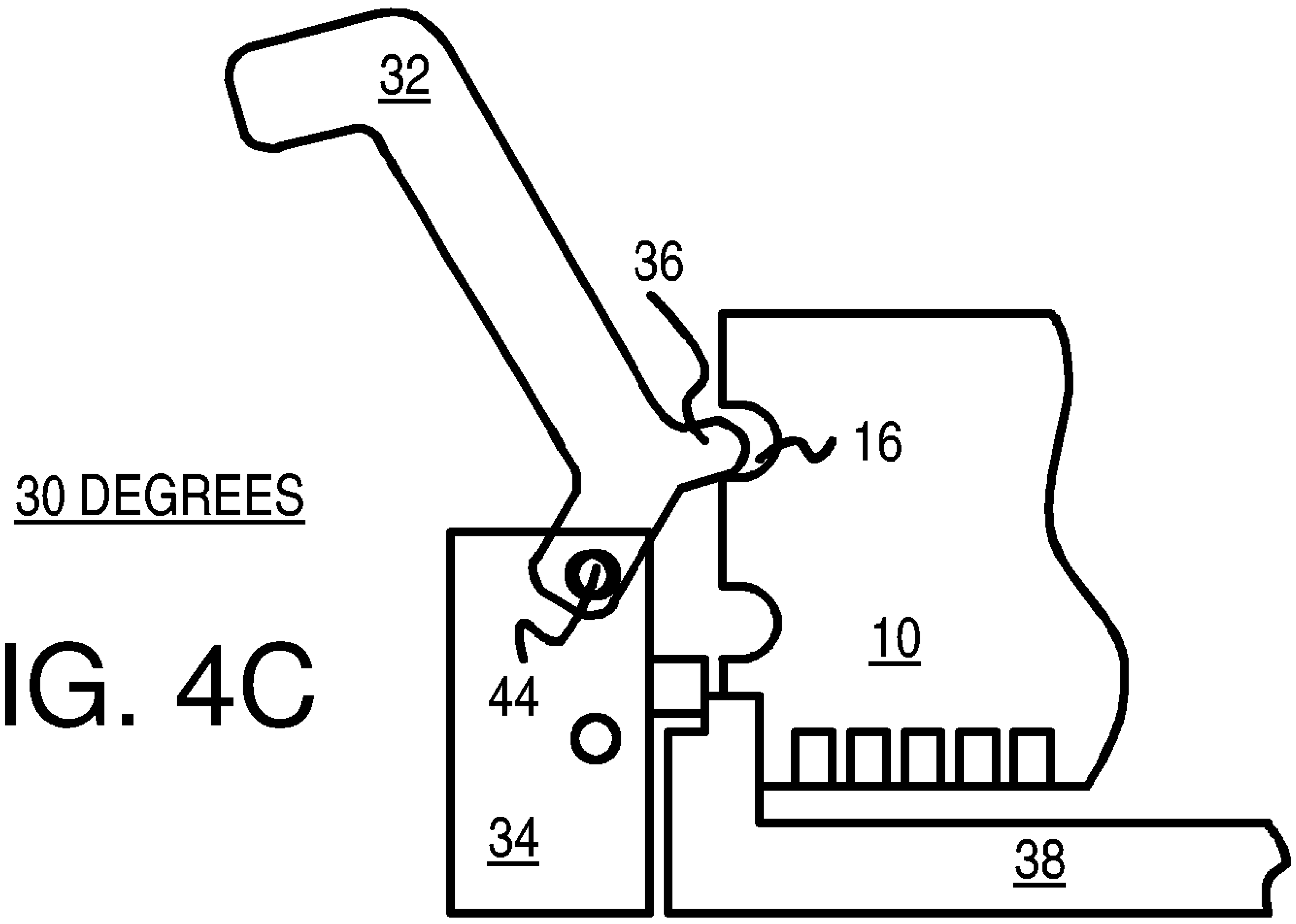


FIG. 4C

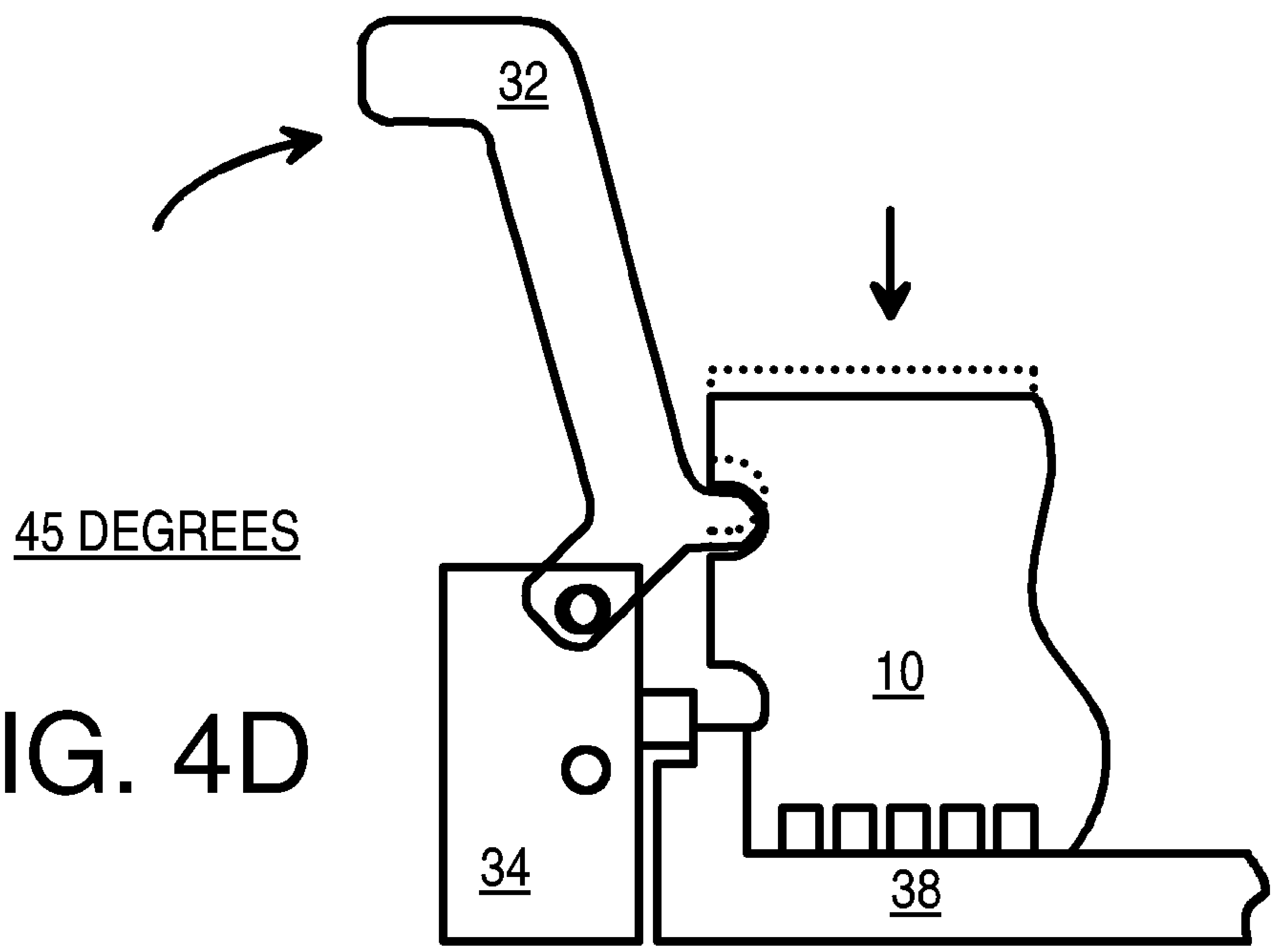


FIG. 4D

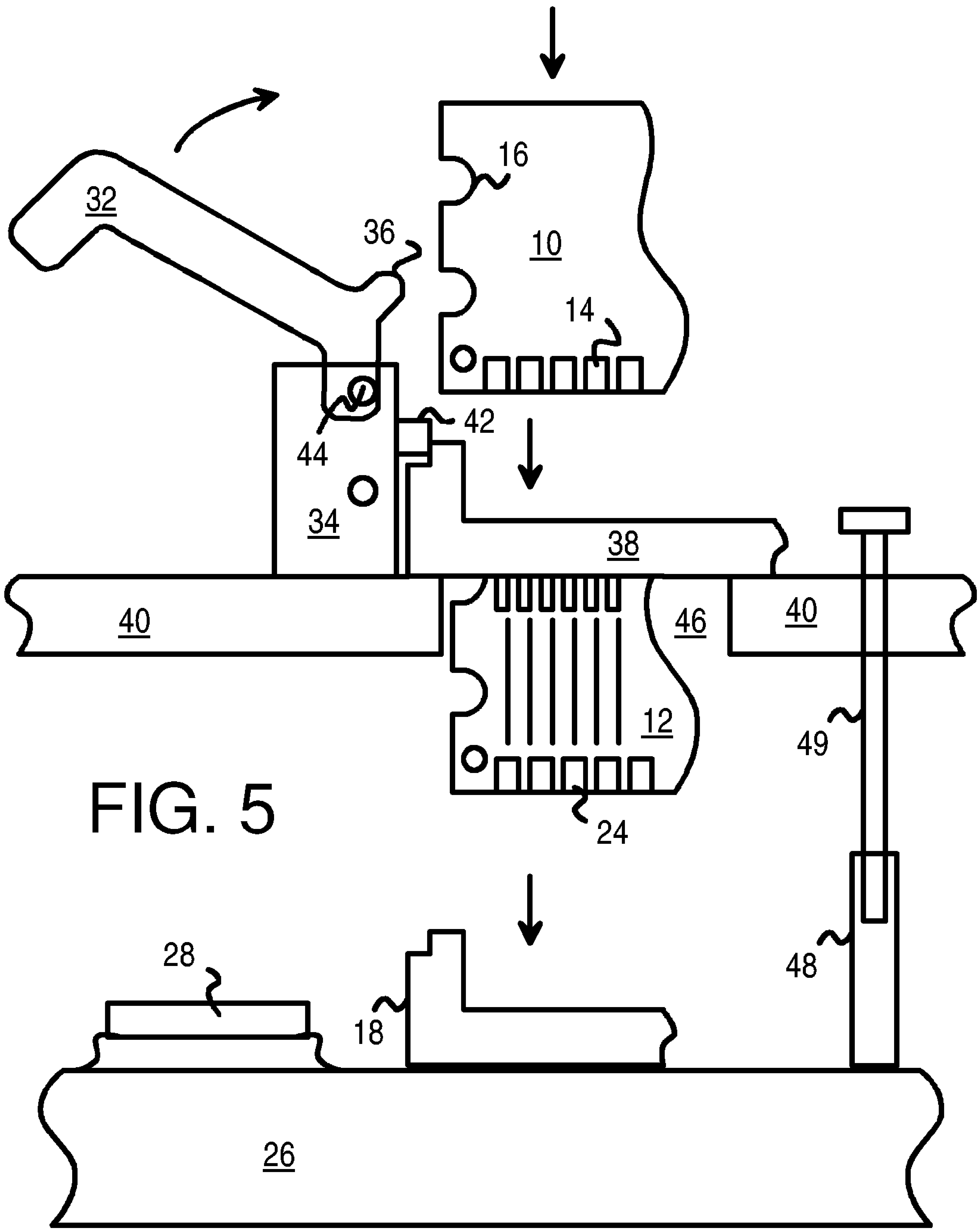


FIG. 5

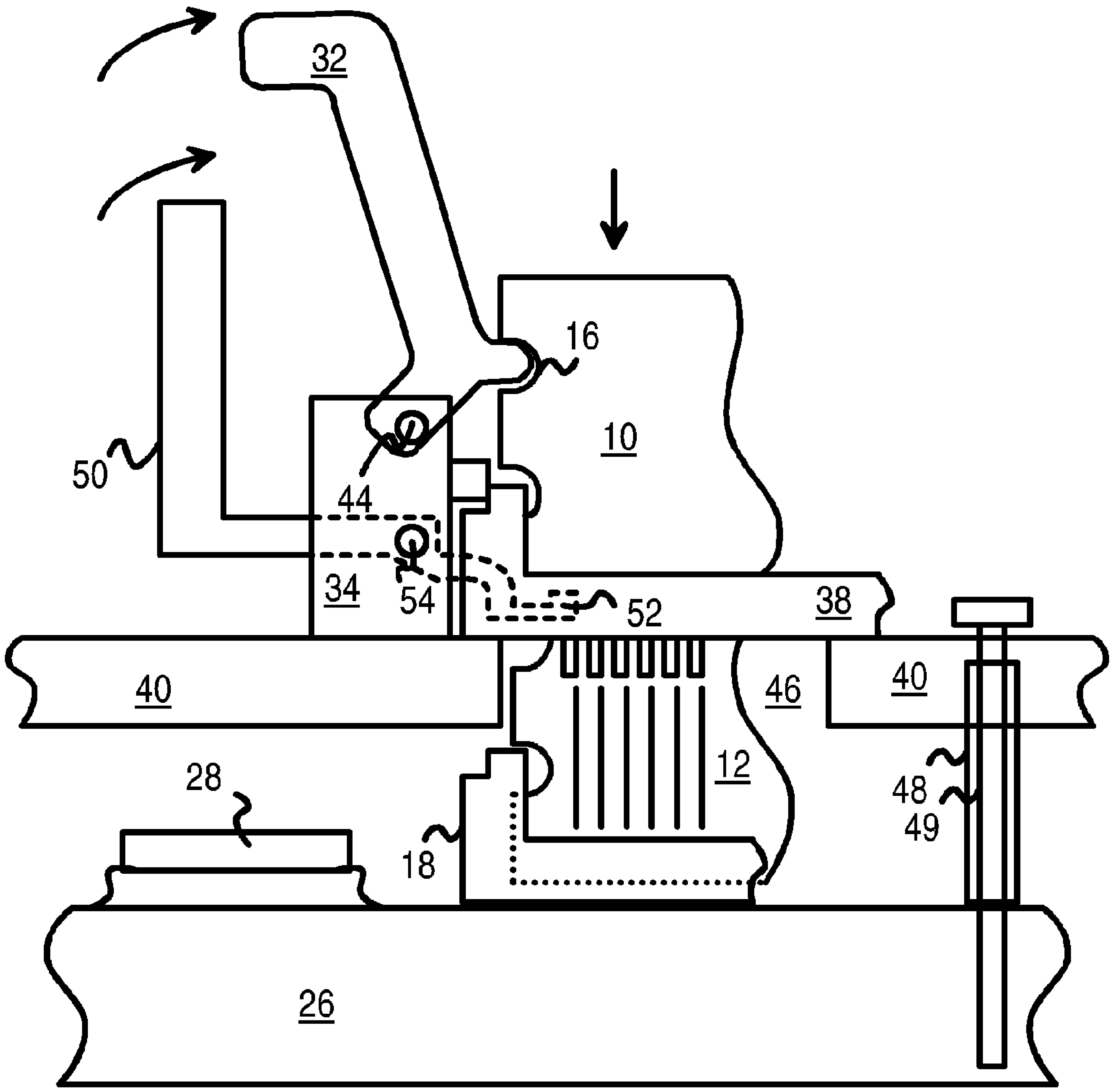


FIG. 6A

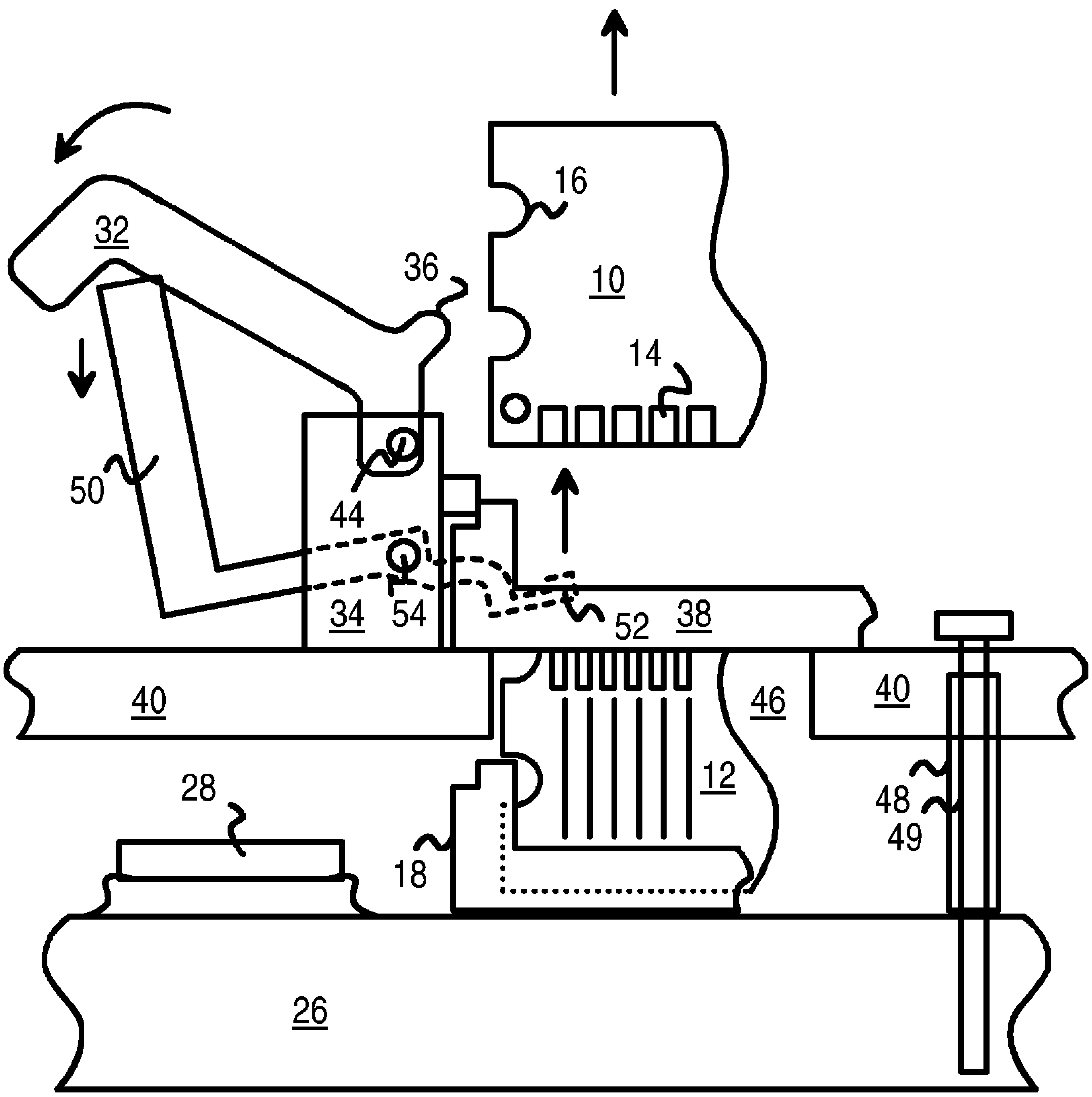


FIG. 6B

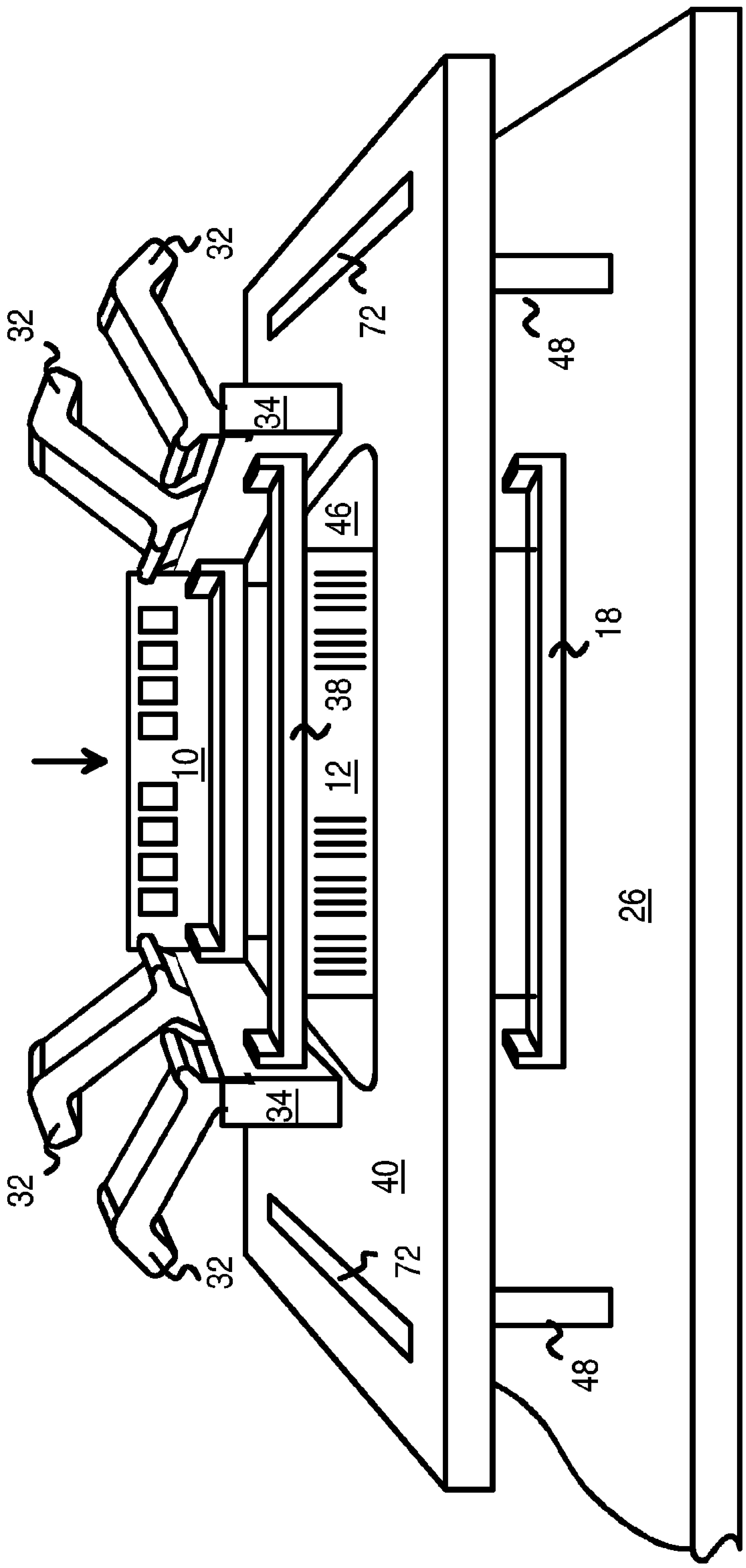


FIG. 7

PC-MOTHERBOARD TEST SOCKET WITH LEVERED HANDLES ENGAGING AND PUSHING MEMORY MODULES INTO EXTENDER-CARD SOCKET AND ACTUATING EJECTORS FOR REMOVAL

FIELD OF THE INVENTION

This invention relates to memory-module test sockets, and more particularly to memory-module test sockets with levered handles to aid module insertion.

BACKGROUND OF THE INVENTION

Memory modules such as dual-inline memory modules (DIMMs) are widely used in a variety of systems such as personal computers (PCs). Since profit margins for memory module manufactures are low, manufacturing costs must be reduced. Testing costs can be reduced by testing memory modules on a low-cost modified PC motherboard rather than an expensive electronic-component tester.

An extender card can be inserted into a memory module socket on a standard PC motherboard. This extender card has another memory module socket mounted on a top edge, while the bottom edge is inserted into the motherboard's memory module socket. The extender card effectively raises the location of the open memory module socket up off the surface of the motherboard, allowing easier access to the socket.

FIG. **1** shows a memory module extender card between a PC motherboard and a memory module being tested by the motherboard. Motherboard **26** has components **28** and memory module socket **18** mounted on a component side. Many components such as integrated circuit (IC) chips, resistors, capacitors, fans, connectors, and plugs can be mounted, and many motherboards have two or four memory module sockets **18**.

Normally, memory module **10** is inserted directly in memory module socket **18** so that metal contacts **14** mate with metal contacts inside memory module socket **18**. However, cables and components **28** may crowd around memory module socket **18**, making it difficult to insert memory module **10**. While module insertion is performed rarely in an end-user PC, when motherboard **26** is used to test memory modules, such restricted access is problematic.

Easier insertion of memory module **10** during such testing is provided by extender card **12**. Metal contacts **24** on the bottom edge of extender card **12** are inserted into memory module socket **18**. Metal traces on extender card **12** connect signals from metal contacts **24** to corresponding contacts inside extender socket **20**.

During testing, memory module **10** is inserted into extender socket **20** on extender card **12**. Since extender socket **20** is raised above memory module socket **18** on motherboard **26**, socket access, and insertion and removal of memory module **10** are facilitated.

Some memory module sockets feature retention devices to lock the memory module into the socket. This prevents accidental loosening of the connection, or even loss of the memory module. For example, clip **22** on extender socket **20** can be moved inward to clip into notch **16** on memory module **10** after memory module **10** is fully inserted. Memory module socket **18** on motherboard **26** may also have such clips **22** for retention.

FIGS. **2**A–B show operation of a retention clip on a memory module socket. Retention clip **22** is in the open position, moved outward and away from extender socket **20**.

Memory module **10** is inserted into extender socket **20** with retention clip **22** open, as shown in FIG. **2**A. Notch **16** is lined up with retention clip **22** when memory module **10** is fully inserted into extender socket **20**.

In FIG. **2**B, retention clip **22** is moved inward, causing a knob on retention clip **22** to engage inside notch **16** on memory module **10**. The knob on retention clip **22** engaging notch **16** prevents accidental removal of memory module **10**.

However, memory module **10** must be fully inserted into extender socket **20** before retention clip **22** can be clipped into notch **16**. A fair amount of force needs to be applied to memory module **10** by the user to insert memory module **10** fully into extender socket **20**.

While insertion force may be significant, the force necessary for removal may be more difficult to apply, since it is a pulling rather than a pushing force. Some memory module sockets are equipped with ejectors to initially remove or start removal of an inserted memory module.

FIGS. **3**A–B show operation of an ejector in a memory module socket. An extension of retention clip **22** may be formed below the fulcrum or pivot point of retention clip **22**. This extension is normally hidden from view, inside extender socket **20**. The extension of retention clip **22** is extension ejector **30** in FIGS. **3**A–B.

When memory module **10** is fully inserted into extender socket **20**, and retention clip **22** is clipped into notch **16**, as shown in FIG. **3**A, extension ejector **30** is in its lowest position, below memory module **10**. The bottom (connector) edge of memory module **10** may touch a foot portion on the end of extension ejector **30**.

To begin removal of memory module **10**, a user pulls outward retention clip **22**, as shown in FIG. **3**B. As retention clip **22** is moved outward, extension ejector **30** pivots upward inside extender socket **20**. The foot of extension ejector **30** pushes upward against the bottom edge of memory module **10**, forcing memory module **10** upward out of extender socket **20**. Typically extension ejector **30** only moves memory module **10** upward a slight distance, and the user finished removal of memory module **10** by pulling upward on it.

While such retention clips and extender cards are useful, a strong force is often needed to insert the memory module. When a technician or test operator has to manually force memory modules into test sockets, such forces can produce repetitive stress injuries or may damage the memory module, extender card, or motherboard tester. Often memory modules must be replaced every 2–5 minutes in a test or lab environment.

What is desired is a memory module extender socket with an insertion aid. A memory module socket that uses leverage to increase the user's force on the memory module during insertion is desirable. A test apparatus with extender cards and leveraged insertion of memory modules into sockets is desirable.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a memory module extender card between a PC motherboard and a memory module being tested by the motherboard.

FIGS. **2**A–B show operation of a retention clip on a memory module socket.

FIGS. **3**A–B show operation of an ejector in a memory module socket.

FIGS. **4**A–D illustrate operation of a leveraged handle to apply an insertion force on a memory module being inserted into a memory module socket.

FIG. **5** shows a test adapter board with an extender card and a levered handle for aiding insertion of memory modules.

FIGS. **6**A–B show operation of an ejector activated by the levered handle on a test adapter board.

FIG. **7** is a perspective view of a motherboard tester with the test adaptor board with levered handles to ease insertion of memory modules.

DETAILED DESCRIPTION

The present invention relates to an improvement in memory module sockets. The following description is presented to enable one of ordinary skill in the art to make and use the invention as provided in the context of a particular application and its requirements. Various modifications to the preferred embodiment will be apparent to those with skill in the art, and the general principles defined herein may be applied to other embodiments. Therefore, the present invention is not intended to be limited to the particular embodiments shown and described, but is to be accorded the widest scope consistent with the principles and novel features herein disclosed.

The inventors have realized that leverage can be used to increase the user's force on a memory module during insertion. Rather than simply retaining the memory module in the socket after insertion, as retention clips do, levered handles apply downward force on a memory module before it is fully inserted. Thus insertion of memory modules into sockets is eased.

FIGS. **4**A–D illustrate operation of a leveraged handle to apply an insertion force on a memory module being inserted into a memory module socket. In FIG. **4**A, memory module **10** is partially inserted by a user into a slot opening in memory module socket **38**. Guides along the sides of memory module socket **38** may guide memory module **10** into position.

Levered handle **32** is in the fully opened position. Notch engager **36** is formed on levered handle **32** and is tiled away from memory module **10** being inserted into memory module socket **38**.

In FIG. **4**B, levered handle **32** is pivoted about 30 degrees around its pivot point, axis **44** on mount **34**. The far end of levered handle **32** if lifted by the user, causing notch engager **36** to be moved downward and toward memory module **10**. With memory module **10** inserted a proper amount into memory module socket **38**, notch **16** aligns with notch engager **36** when levered handle **32** is rotated about axis **44**. If notch **16** on memory module **10** is too high relative to notch engager **36**, then the user can push memory module farther down into memory module socket **38** until notch **16** aligns with notch engager **36**.

The bottom of notch engager **36** begins to push against the bottom of notch **16** as levered handle **32** is lifted further. In FIG. **4**C, notch engager **36** has just started to push down against notch **16**. As levered handle **32** is rotated further, from 30 degrees on to 45 degrees from the initial position of FIG. **4**A, memory module **10** is forced downward, farther into memory module socket **38**.

In FIG. **4**D, after levered handle **32** has been rotated the full 45 degrees, memory module **10** is fully inserted into memory module socket **38**. Good electrical contact is made between the metal contacts on memory module **10** and those in memory module socket **38**.

While the amount of downward movement of memory module **10** as levered handle **32** is rotated from 30 to 45 degrees may appear to be small, as shown by the dotted lines of memory module **10** in FIG. **4**D, this portion of module insertion often required the greatest force as the metal contacts rub together and make their tightest fit. Thus the user is spared from direct application of the greatest force by use of levered handle **32**. Due to its leveraging ability, levered handle **32** multiplies the force applied by the user, resulting in a greater force applied to memory module **10** by notch engager **36** than the user applies to the end of levered handle **32**. Of course, should the user hold levered handle **32** in the middle of its arm, rather than the far end, the amount of leverage is reduced, and the user must apply greater force.

While levered handle **32**, notch engager **36**, and mount **34** may be part of or mounted next to a standard memory module socket, such as a socket on a PC motherboard, one embodiment uses them as part of a test adapter board. FIG. **5** shows a test adapter board with an extender card and a levered handle for aiding insertion of memory modules.

Levered handle **32**, shown in its open position, is lifted upward by a user to rotate about axis **44** on mount **34**, causing notch engager **36** to engage notch **16** in memory module **10** when memory module **10** is inserted a proper, partial amount into memory module socket **38**. The force exerted by notch engager **36** onto notch **16** forces memory module **10** downward so that metal contacts **14** mate with contacts inside memory module socket **38**.

Only the left end of memory module socket **38** is shown. Another levered handle **32** mounted to another mount **34** are on the right end of memory module socket **38** and apply force on that right end of memory module **10** in a similar fashion. These right-side elements are not shown, but can be seen in FIG. **7**.

Mount **34** is itself mounted to base board **40**, which can be attached above motherboard **26** by several standoffs **48**. Screw or bolt **49** can fit through a hole in base board **40**, through a hollow center of standoff **48**, and through another hole in motherboard **26**. Other kinds of board attachments can be substituted for standoffs **48**.

Standoffs **48** and the height of extender card **12** can be made tall enough to allow for sufficient clearance or space between base board **40** and motherboard **26** so that components **28** have enough air flow for cooling.

Memory module socket **38** is part of extender card **12**, being attached to an upper edge of extender card **12**. The lower edge of extender card **12** has metal contacts **24**, which fit inside memory module socket **18** on motherboard **26**. Extender card **12** fits in opening **46** in base board **40**. Opening **46** is wider than extender card **12**, but not as wide as memory module socket **38**, allowing the ends of memory module socket **38** to rest on the upper surface of base board **40** around opening **46**.

Bar **42** on mount **34** can fit in a notch on the ends of memory module socket **38** as shown, to hold memory module socket **38** down on the top surface of base board **40**. Memory module socket **38** and extender card **12** can be held firmly in place to base board **40**, which can then be lowered into position over motherboard **26**, as metal contacts **24** of extender card **12** are fitted into memory module socket **18**.

FIGS. **6**A–B show operation of an ejector activated by the levered handle on a test adapter board. Base board **40** is shown mounted to motherboard **26** by standoffs **48** and bolt **49**. Three, four, or more of such standoffs **48** may be used, preferably using existing holes on motherboard **26**. Levered handle **32** operates as described before, with notch engager **36** engaging and pushing on notch **16** to apply downward force on memory module **10**, forcing it into memory module socket **38**. In FIG. **6**A memory module **10** is fully inserted.

Ejector foot **52** is pushed downward by the bottom edge of memory module **10** when fully inserted, causing ejector arm **50** to be in the upright position shown in FIG. **6**A. Ejector foot **52** and ejector arm **50** are on opposite sides of ejector pivot **54**, which can be an axis such as a bolt, as can axis **44** of levered handle **32**.

During ejection, the user pushed down on the end of levered handle **32**, causing it to rotate about axis **44**. Notch engager **36** is pulled out from notch **16**. As levered handle **32** is pushed downward, it contacts the top of ejector arm **50**. Ejector arm **50** is pushed downward and outward, rotating around ejector pivot **54**. Since ejector foot **52** is fixed to ejector arm **50** through ejector pivot **54**, ejector foot **52** rotates upward around ejector pivot **54**, applying an upward force on the bottom edge of memory module **10**. Memory module is forced out of memory module socket **38** by a slight amount. Since the greatest ejection force is often the initial movement of memory module **10**, this initial ejection reduces the force required of the user to pull memory module **10** completely out of memory module socket **38**.

The combination of levered handle **32**, which applies an insertion force through notch engager **36**, and ejector arm **50**, which provides an ejection force through ejector pivot **54**, reduces the forces the user applies to memory module **10**. This can reduce the possibility of injuries to the user, such as repetitive-stress injuries.

FIG. **7** is a perspective view of a motherboard tester with the test adaptor board with levered handles to ease insertion of memory modules. Test programs that test memory can be executed on motherboard **26**, such as memory tests during boot-up or more extensive tests run after initialization. A memory module is normally inserted into memory module socket **18** in a standard PC, but instead extender card **12** is inserted into memory module socket **18**. The top of extender card **12** has memory module socket **38** that receives memory module **10** for testing.

More than one memory module **10** may be tested at a time. A second extender card **12** with a second memory module socket **38** can also be supported by base board **40**. Two pairs of levered handles **32** can be fitted on mounts **34**, each pair engaging a notch **16** on a different memory module **10** being inserted into a different memory module socket **38**. In another embodiment, each levered handle **32** can engage two memory modules **10**, with two memory module sockets **38** for each pair of levered handles **32**. One opening **46** can have four extender cards **12**, or two or more separate openings **46** may be used.

Ribs **72** may be formed on base board **40**. Ribs **42** may fit inside a heater cover (not shown) that can be placed over memory modules **10** when inserted into memory module sockets **38**. The heater cover and base board **40** form a heat chamber that allows memory modules **10** to be heated and tested at an elevated temperature. The heater cover could also be attached to base board **40** by a hinge.

ALTERNATE EMBODIMENTS

Several other embodiments are contemplated by the inventors. For example base board **40** may have a variety of shapes and have various cutouts and openings **46** to fit extender cards **12** and components on motherboard **26** that protrude above base board **40**. Base board **40** may be made from a thicker, more insulating material or fiberglass to improve the heat chamber. While engagement of notch engager **36** with an upper notch **16** of memory module **10** has been shown, engagement with a lower notch or other feature of a memory module could occur with an appropriate position and design of levered handle **32**, axis **44**, and notch engager **36**. Rotations of different amounts other than 30 or 45 degrees can be designed for by changes to levered handle **32**, mount **34**, notch engager **36**, and their positions relative to notch **16** and memory module socket **38**. The length or levered moment arm of levered handle **32** may be increased or decreased, changing the leverage efficiency.

More than one memory module socket may be used on base board **40**. Each levered handle **32** could engage just one notch on one memory module, or notch engager **36** could have an elongated depth (the direction normal to the plane of FIG. **5**) so that notched on two or more memory modules could be engaged simultaneously.

Various other enhancements can be made, such as locks, stops, or holding mechanisms for holding levered handle **32** in its various positions. The levered handles could be attached to a base that is attached directly to a memory module socket, without using a base board **40**.

Positions such as up, down, etc. are relative and may be interchangeable, such as when the socket is transformed or re-positioned. The levered handle can be made from a variety of materials such as metal or rigid plastic. The notch engager can be integral with the levered handle or attached to the levered handle.

Rather than use bar **42** (see FIG. **5**), a screw (not shown) horizontally through mount **34** can attach to the side of memory module socket **38** to hold memory module socket **38** and extender card **12** in place on base board **40**. Memory module socket **38** could be mounted to base board **40** or to mount **34** in a variety of other ways, such as by adhesive, clamps, screws or bolts in various locations, etc. The shape and size of opening **46** can vary, such as one or more long rectangles or ovals to closely fit one or more extender cards **12**, or other shapes.

Any advantages and benefits described may not apply to all embodiments of the invention. When the word "means" is recited in a claim element, Applicant intends for the claim element to fall under 35 USC Sect. 112, paragraph 6. Often a label of one or more words precedes the word "means". The word or words preceding the word "means" is a label intended to ease referencing of claims elements and is not intended to convey a structural limitation. Such means-plus-function claims are intended to cover not only the structures described herein for performing the function and their structural equivalents, but also equivalent structures. For example, although a nail and a screw have different structures, they are equivalent structures since they both perform the function of fastening. Claims that do not use the word "means" are not intended to fall under 35 USC Sect. 112, paragraph 6. Signals are typically electronic signals, but may be optical signals such as can be carried over a fiber optic line.

The foregoing description of the embodiments of the invention has been presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of the above teaching. It is intended that the scope of the invention be limited not by this detailed description, but rather by the claims appended hereto.

What is claimed is:

1. A memory module test socket comprising:

a memory module connector socket having a slot for receiving a connector edge of a memory module, the slot having metal contacts for contacting metal contacts by the connector edge of the memory module;

the memory module connector socket having a middle portion having the slot and having end portions on opposing sides of the middle portion;

a levered handle pivoting near the end portion of the memory module connector socket;

an axis of the levered handle, the levered handle pivoting around the axis in an insertion direction;

a notch engager on the levered handle, the notch engager positioned to engage a notch on an edge of the memory module when the memory module is inserted and the levered handle is pivoted in the insertion direction around the axis; and

wherein the notch engager exerts a downward force on the notch of the memory module when the levered handle is pivoted around the axis in the insertion direction, the downward force on the notch causing the memory module to be forced into the slot of the memory module connector socket,

whereby the memory module is forced into the slot by the notch engager on the levered handle being pivoted in the insertion direction.

2. The memory module test socket of claim **1** wherein the levered handle pivots in a plane of the memory module when inserted into the slot, the axis being perpendicular to the plane, the memory module having a printed-circuit board (PCB) with major surfaces in the plane or parallel to the plane.

3. The memory module test socket of claim **2** wherein the notch engager pivots away from the notch and the memory module when the levered handle is pivoted around the axis in a direction opposite to the insertion direction for removal of the memory module.

4. The memory module test socket of claim **3** further comprising:

guides in the end portions of the memory module connector, the guides for receiving edges of the memory module to slide along when the memory module is being inserted.

5. The memory module test socket of claim **3** wherein the axis is formed in a mount attached to the end portion of the memory module connector socket or is formed in the end portion of the memory module connector socket.

6. The memory module test socket of claim **3** wherein the notch engager and a major arm of the levered handle are on a same side of the axis.

7. The memory module test socket of claim **3** wherein a force applied by a user to an end of the levered handle is multiplied by leverage to create the downward force that the notch engager exerts on the notch of the memory module.

8. The memory module test socket of claim **7** further comprising:

an ejector axis parallel to the axis;

an ejector arm that pivots about the ejector axis;

an ejector foot, fixed to the ejector arm so that the ejector foot pivots about the ejector axis when the ejector arm pivots;

wherein the ejector foot presses upward against the connector edge of the memory module when the memory module is inserted into the slot and the ejector arm is pivoted to eject the memory module;

wherein the ejector foot exerts an ejecting pressure against the memory module that is fully inserted and the ejector arm is pivoted in an ejecting direction.

9. The memory module test socket of claim **8** wherein the levered handle presses against the ejector arm to pivot the ejector arm in the ejecting direction when the levered handle is pivoted in the direction opposite the insertion direction.

10. The memory module test socket of claim **9** further comprising:

an extender card having the memory module connector socket mounted on a top edge, and

a connector edge having metal contacts for insertion in a memory module socket on a personal computer motherboard.

11. The memory module test socket of claim **10** further comprising:

a base board having the end portions of the memory module connector socket mounted thereon, the base board having an opening under at least part of the middle portion of the memory module connector socket, the opening for the extender card to pass through to reach a memory module socket on a motherboard below the base board.

12. The memory module test socket of claim **11** further comprising:

a first mount, mounted to the base board, connected to the levered handle by the axis, the first mount mounted near a first end of the memory module connector socket, the first end being one of the end portions;

a second levered handle pivoting near a second end of the memory module connector socket, the second end being one of the end portions;

a second axis of the second levered handle, the second levered handle pivoting around the second axis in a second insertion direction;

a second notch engager on the second levered handle, the second notch engager positioned to engage a second notch on the memory module when the memory module is inserted and the second levered handle is pivoted in the second insertion direction around the second axis;

wherein the second notch engager exerts a downward force on the second notch of the memory module when the second levered handle is pivoted around the second axis in the second insertion direction, the downward force on the second notch also causing the memory module to be forced into the slot of the memory module connector socket; and

a second mount, mounted to the base board, connected to the second levered handle by the second axis, the second mount mounted near the second end of the memory module connector socket, the second end being one of the end portions.

13. A test apparatus comprising:

socket means for receiving a connector edge of a memory module under test;

motherboard means for executing test programs to test the memory module under test, the motherboard means having a memory module socket;

extender card means for electrically connecting contacts inside the socket means to metal contacts on a card connector edge of the extender card means, the card connector edge for insertion into the memory module socket on the motherboard means;

base board means, mounted above the memory module socket on the motherboard means and having an opening directly above the memory module socket, for supporting the socket means above the motherboard means;

first levered handle means for pivoting about a first axis;

first mount means, mounted to the base board means by a first end of the socket means, for supporting the first levered handle means at the first axis; and first notch engage means, fixedly coupled to the first levered handle means, for engaging a first notch on the memory module under test;

wherein the first notch engage means applies an insertion force on the first notch when the first levered handle means is pivoted about the first axis in a first insertion direction, the insertion force forcing the connector edge of the memory module under test into the socket means,

whereby the insertion force is produced by pivoting the first levered handle means in the first insertion direction.

14. The test apparatus of claim **13** further comprising:

second levered handle means for pivoting about a second axis;

second mount means, mounted to the base board means by a second end of the socket means, for supporting the second levered handle means at the second axis; and

second notch engage means, fixedly coupled to the second levered handle means, for engaging a second notch on the memory module under test;

wherein the second notch engage means applies an insertion force on the second notch when the second levered handle means is pivoted about the second axis in a second insertion direction, the insertion force forcing the connector edge of the memory module under test into the socket means.

15. The test apparatus of claim **14** further comprising:

back socket means for receiving a connector edge of a second memory module under test;

wherein the motherboard means executes test programs to test the memory module under test and the second memory module under test, the motherboard means having a second memory module socket;

second extender card means for electrically connecting contacts inside the back socket means to metal contacts on a card connector edge of the second extender card means, the card connector edge for insertion into the second memory module socket on the motherboard means;

first back levered handle means for pivoting about a first back axis;

first back mount means, mounted to the base board means by a first end of the back socket means, for supporting the first back levered handle means at the first back axis;

first back notch engage means, fixedly coupled to the first back levered handle means, for engaging a first back notch on the second memory module under test;

wherein the first back notch engage means applies an insertion force on the first back notch when the first back levered handle means is pivoted about the first back axis in a first back insertion direction, the insertion force forcing the connector edge of the second memory module under test into the back socket means,

second back levered handle means for pivoting about a second back axis;

second back mount means, mounted to the base board means by a second end of the back socket means, for supporting the second back levered handle means at the second back axis; and

second back notch engage means, fixedly coupled to the second back levered handle means, for engaging a second back notch on the second memory module under test;

wherein the second back notch engage means applies an insertion force on the second back notch when the second back levered handle means is pivoted about the second back axis in a second back insertion direction, the insertion force forcing the connector edge of the second memory module under test into the back socket means,

whereby two memory modules are inserted and tested.

16. The test apparatus of claim **15** further comprising:

first ejector means, activated by pivoting of the first levered handle means in a direction opposite to the first insertion direction, for applying an ejecting force onto the connector edge of the memory module under test,

whereby module ejection is assisted by movement of the first levered handle means.

17. A reduced-insertion-force memory module socket comprising:

a first supporting mount having a first axis;

a second supporting mount having a second axis substantially parallel to the first axis;

a memory module socket between the first and second supporting mounts, the memory module socket having its longest dimension between the first and second supporting mounts, the memory module socket having a slot for receiving a connector edge of a memory module under test;

a first levered handle connected to the first supporting mount by the first axis and rotating about the first axis;

a first notch engager on the first levered handle, the first notch engager fitting into a first notch on a first end of the memory module under test when partially inserted into the memory module socket;

wherein the first notch engager is closer to the first axis than an end of the first levered handle;

a second levered handle connected to the second supporting mount by the second axis and rotating about the second axis; and

a second notch engager on the second levered handle, the second notch engager fitting into a second notch on a second end of the memory module under test when partially inserted into the memory module socket;

wherein the second notch engager is closer to the second axis than an end of the second levered handle;

wherein the first notch engager applies a first insertion force onto the first notch when the first levered handle is rotated in an insertion movement, the first insertion force forcing the connector edge of the memory module under test firmly into the slot of the memory module socket;

wherein the second notch engager applies a second insertion force onto the second notch when the second levered handle is rotated in an insertion movement, the second insertion force forcing the connector edge of the memory module under test firmly into the slot of the memory module socket;

wherein the first and second insertion forces are generated by the insertion movements of the first and second levered handles.

18. The reduced-insertion-force memory module socket of claim **17** wherein the first axis and the second axis are both substantially perpendicular to a plane of a component surface of the memory module under test when inserted.

19. The reduced-insertion-force memory module socket of claim **18** further comprising:

a base board that has the first and second bases mounted on a surface, and has an opening for an extender card attached to the memory module socket;

wherein the extender card has a connector edge for insertion into a memory module socket on a motherboard tester.

20. The reduced-insertion-force memory module socket of claim **19** wherein the first supporting mount further comprises a hold-down bar or a screw to hold the memory module socket to the base board;

wherein the second supporting mount further comprises a hold-down bar or a screw to hold the memory module socket to the base board.

21. The reduced-insertion-force memory module socket of claim **19** wherein the first notch engager has a rounded cross-sectional shape that at least partially matches a shape of the first notch on the memory module under test;

wherein the second notch engager has a rounded cross-sectional shape that at least partially matches a shape of the second notch on the memory module under test.

22. The reduced-insertion-force memory module socket of claim **19** further comprising:

a heat-chamber cover for covering the memory module under test when inserted into the memory module socket;

wherein the heat-chamber cover and the base board form a heat chamber that allows the memory module under test to be tested at an elevated temperature.

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